

Online monitoring of chlorophyll a fluorescence in *Nannochloropsis oceanica* to assess photochemical changes and the onset of lipid accumulation during nitrogen deprivation

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Abstract

In this work, we applied online chlorophyll a fluorescence measurements to monitor the changes in the photochemical parameters both in nitrate-deplete and nitrate-replete cultures of *Nannochloropsis oceanica*, in addition to biochemical parameters such as growth, lipid, fatty acid, and pigment contents. Under nitrate-replete conditions, growth was promoted along with pigment content, while total lipid content and fatty acid saturation level diminished. Under nitrate-deplete conditions, cultures showed an increased de-epoxidation state of the xanthophyll cycle pigments. Fast transients revealed a poor processing efficiency for electron transfer beyond QA, which was in line with the low electron transport rate due to nitrate depletion. Lipid content and the de-epoxidation state were the first biochemical parameters triggered by the change in nutrient status, which coincided with a 20% drop in the online effective quantum yield of PSII ($\Delta F/Fm'$), and a raise in the V_j measurements. A good correlation was found between the changes in $\Delta F/Fm'$ and lipid content ($r=-0.96$, $p<0.01$). The results confirm the reliability and applicability of online fluorescence measurements to monitor lipid induction in *N. oceanica*.

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